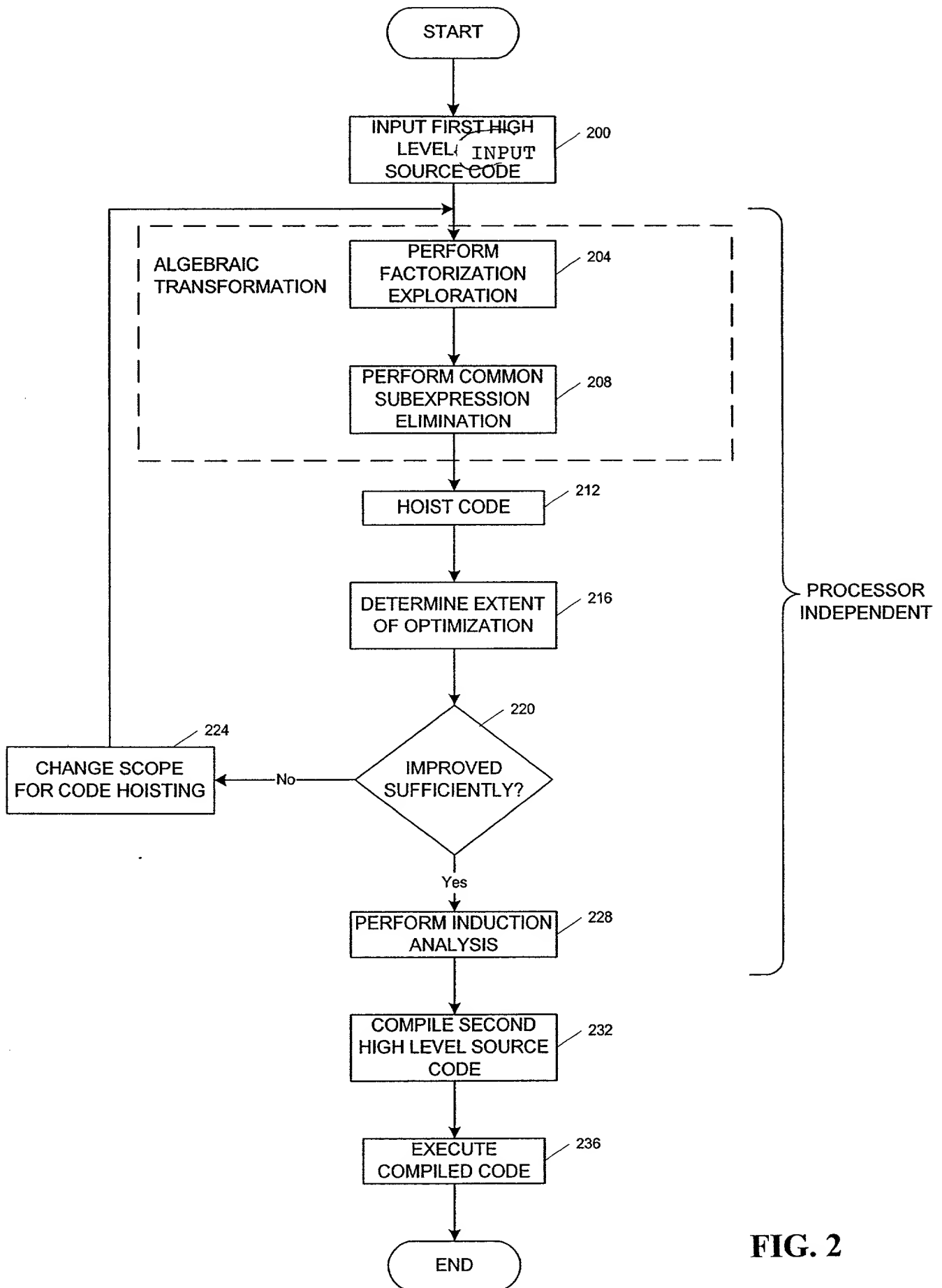


**FIG. 1**



```

for (y=0; y<M+3; ++y) {
  for (x=0; x<N+5; ++x) {
    ...
    if ((x-3)>=1 && (x-5)<=N-2 && (y-2)>=1 && (y-3)<=M-2) {
      if ((x-5)>=1 && (y-3)>=1) {
        if (out_compute == 255) {
          if (comp_edge_pixels[((x-4)%3)*3+(y-2)%3]<comp_edge_middle) out_compute=0;
          ...
          if (comp_edge_pixels[((x-4)%3)*3+(y-4)%3]<comp_edge_middle) out_compute=0;
          ...
          if (comp_edge_pixels[((x-5)%3)*3+(y-4)%3]<comp_edge_middle) out_compute=0;
          ...
        }
      }
      if ((x-3)<=N-2 && (y-2)<=M-2) {
        maxdiff_compute =
          max13(abs(gauss_xy_pixels[((x-2)%3)*3+(y-1)%3]
            - gauss_xy_middle), maxdiff_compute);
        ...
        maxdiff_compute =
          max13(abs(gauss_xy_pixels[((x-2)%3)*3+(y-3)%3]
            - gauss_xy_middle), maxdiff_compute);
        ...
        maxdiff_compute =
          max13(abs(gauss_xy_pixels[((x-3)%3)*3+(y-3)%3]
            - gauss_xy_middle), maxdiff_compute);
        ...
      }
    }
  }
}

```

**FIG. 3**

```

for (y=0; y<M+3; ++y) {
  for (x=0; x<N+5; ++x) {
    ...
    if (x>=4 && x<=N+3 && y>=3 && y<=M+1) {
      if ((x-5)>=1 && (y-3)>=1) {
        if (out_compute == 255) {
          csexmin4mod3x3 = ((x-4)%3)*3;
          cseymin4mod3 = (y-4)%3;
          if (comp_edge_pixels[csexmin4mod3x3 + (y-2)%3] < comp_edge_middle) out_compute=0;
          ...
          if (comp_edge_pixels[csexmin4mod3x3 + cseymin4mod3] < comp_edge_middle) out_compute=0;
          ...
          if (comp_edge_pixels[((x-5)%3)*3 + cseymin4mod3] < comp_edge_middle) out_compute=0;
          ...
        }
      }
      if ((x-3)<=N-2 && (y-2)<=M-2) {
        csexmin2mod3x3 = ((x-2)%3)*3;
        cseymod3 = y%3; /* = (y-3)%3 */
        maxdiff_compute =
          maxl3(abs(gauss_xy_pixels[csexmin2mod3x3 + (y-1)%3]
                    - gauss_xy_middle), maxdiff_compute);
        ...
        maxdiff_compute =
          maxl3(abs(gauss_xy_pixels[csexmin2mod3x3 + cseymod3]
                    - gauss_xy_middle), maxdiff_compute);
        ...
        maxdiff_compute =
          maxl3(abs(gauss_xy_pixels[(x%3)*3 + cseymod3]
                    - gauss_xy_middle), maxdiff_compute);
        ...
      }
    }
  }
}

```

**FIG. 4**

distributivity:  $(x + 4)\%3 = (x\%3 + 4\%3)\%3$   
constant folding:  $= (x\%3 + 1)\%3$   
constant unfolding:  $= (x\%3 + 1\%3)\%3$   
invert distributivity:  $= (x + 1)\%3$   
(a)

modulo expansion:  $(x+2)\%3 = 3 - x\%3 - (x+1)\%3$   
(b)

**FIG. 5**

```

for (y=0; y<M+3; ++y) {
  cseymod3 = y%3;
  cseymin1mod3 = (y-1)%3;
  cseymin2mod3 = (y-2)%3;
  cseymin4mod3 = (y-4)%3;
  for (x=0; x<N+5; ++x) {
    ...
    if (x>=4 && x<=N+3 && y>=3 && y<=M+1) {
      if ((x-5)>=1 && (y-3)>=1) {
        if (out_compute == 255) {
          csexmin4mod3x3 = ((x-4)%3)*3;
          if (comp_edge_pixels[csexmin4mod3x3 + cseymin2mod3] < comp_edge_middle) out_compute=0;
          ...
          if (comp_edge_pixels[csexmin4mod3x3 + cseymin4mod3] < comp_edge_middle) out_compute=0;
          ...
          if (comp_edge_pixels[((x-5)%3)*3 + cseymin4mod3] < comp_edge_middle) out_compute=0;
          ...
        }
      }
      if ((x-3)<=N-2 && (y-2)<=M-2) {
        csexmin2mod3x3 = ((x-2)%3)*3;
        maxdiff_compute =
          maxl3(abs(gauss_xy_pixels[csexmin2mod3x3 + cseymin1mod3]
            - gauss_xy_middle), maxdiff_compute);
        ...
        maxdiff_compute =
          maxl3(abs(gauss_xy_pixels[csexmin2mod3x3 + cseymod3]
            - gauss_xy_middle), maxdiff_compute);
        ...
        maxdiff_compute =
          maxl3(abs(gauss_xy_pixels[(x%3)*3 + cseymod3]
            - gauss_xy_middle), maxdiff_compute);
        ...
      }
    }
  }
}

```

**FIG. 6**

```

cseymod3 = -1;
for (y=0; y<M+3; ++y) {
  cseymin1mod3 = cseymod3;
  cseymod3 = y%3;
  cseymin2mod3 = 3-cseymod3-cseymin1mod3;
  for (x=0; x<N+5; ++x) {
    ...
    if(x>=4 && x<=N+3 && y>=3 && y<=M+1) {
      if((x-5)>=1 && (y-3)>=1) {
        if (out_compute == 255) {
          csexmin4mod3x3 = ((x-4)%3)*3;
          if(comp_edge_pixels[csexmin4mod3x3 + cseymin2mod3]<comp_edge_middle) out_compute=0;
          ...
          if(comp_edge_pixels[csexmin4mod3x3 + cseymin1mod3]<comp_edge_middle) out_compute=0;
          ...
          if(comp_edge_pixels[((x-5)%3)*3 + cseymin1mod3]<comp_edge_middle) out_compute=0;
          ...
        }
      }
      if ((x-3)<=N-2 && (y-2)<=M-2) {
        csexmin2mod3x3 = ((x-2)%3)*3;
        maxdiff_compute =
          max13(abs(gauss_xy_pixels[csexmin2mod3x3 + cseymin1mod3]
            - gauss_xy_middle), maxdiff_compute);
        ...
        maxdiff_compute =
          max13(abs(gauss_xy_pixels[csexmin2mod3x3 + cseymod3]
            - gauss_xy_middle), maxdiff_compute);
        ...
        maxdiff_compute =
          max13(abs(gauss_xy_pixels[(x%3)*3 + cseymod3]
            - gauss_xy_middle), maxdiff_compute);
        ...
      }
    }
  }
}
}

```

**FIG. 7**

```

cseymod3 = -1;
for (y=0; y<M+3; ++y) {
  cseymin1mod3 = cseymod3;
  cseymod3 = y%3;
  cseymin2mod3 = 3-cseymod3-cseymin1mod3;
  for (x=0; x<N+5; ++x) {
    ...
    if(x>=4 && x<=N+3 && y>=3 && y<=M+1) {
      csexmod3x3 = (x%3)*3;
      csexmin2mod3x3 = ((x-2)%3)*3;
      csexmin4mod3x3 = ((x-4)%3)*3;
      csexmin5mod3x3 = ((x-5)%3)*3;
      if((x-5)>=1 && (y-3)>=1) {
        if (out_compute == 255) {
          if(comp_edge_pixels[csexmin4mod3x3 + cseymin2mod3]<comp_edge_middle) out_compute=0;
          ...
          if(comp_edge_pixels[csexmin4mod3x3 + cseymin1mod3]<comp_edge_middle) out_compute=0;
          ...
          if(comp_edge_pixels[csexmin5mod3x3 + cseymin1mod3]<comp_edge_middle) out_compute=0;
          ...
        }
      }
      if ((x-3)<=N-2 && (y-2)<=(M-2)) {
        maxdiff_compute =
          maxl3(abs(gauss_xy_pixels[csexmin2mod3x3 + cseymin1mod3]
            - gauss_xy_middle), maxdiff_compute);
        ...
        maxdiff_compute =
          maxl3(abs(gauss_xy_pixels[csexmin2mod3x3 + cseymod3]
            - gauss_xy_middle), maxdiff_compute);
        ...
        maxdiff_compute =
          maxl3(abs(gauss_xy_pixels[csexmod3x3 + cseymod3]
            - gauss_xy_middle), maxdiff_compute);
        ...
      }
    }
  }
}

```

**FIG. 8**



```

cseymod3 = -1;
for (y=0; y<M+3; ++y) {
  cseymin1mod3 = cseymod3;
  cseymod3 = y%3;
  cseymin2mod3 = 3-cseymod3-cseymin1mod3;
  for (x=0; x<N+5; ++x) {
    csexmod3x3 = (x%3)*3;
    csexmin2mod3x3 = ((x-2)%3)*3;
    csexmin4mod3x3 = ((x-4)%3)*3;
    csexmin5mod3x3 = ((x-5)%3)*3;
    ...
    if (x>=4 && x<=N+3 && y>=3 && y<=M+1) {
      if ((x-5)>=1 && (y-3)>=1) {
        if (out_compute == 255) {
          if (comp_edge_pixels[csexmin4mod3x3 + cseymin2mod3] < comp_edge_middle) out_compute=0;
          ...
          if (comp_edge_pixels[csexmin4mod3x3 + cseymin1mod3] < comp_edge_middle) out_compute=0;
          ...
          if (comp_edge_pixels[csexmin5mod3x3 + cseymin1mod3] < comp_edge_middle) out_compute=0;
          ...
        }
      }
      if ((x-3)<=N-2 && (y-2)<=M-2) {
        maxdiff_compute =
          max13(abs(gauss_xy_pixels[csexmin2mod3x3 + cseymin1mod3]
            - gauss_xy_middle), maxdiff_compute);
        ...
        maxdiff_compute =
          max13(abs(gauss_xy_pixels[csexmin2mod3x3 + cseymod3]
            - gauss_xy_middle), maxdiff_compute);
        ...
        maxdiff_compute =
          max13(abs(gauss_xy_pixels[csexmod3x3 + cseymod3]
            - gauss_xy_middle), maxdiff_compute);
        ...
      }
    }
  }
}
}

```

**FIG. 9**

```

cseymod3 = -1;
for (y=0; y<M+3; ++y) {
  cseymod3 = cseymod3;
  cseymod3 = y%3;
  cseymod3 = 3-cseymod3-cseymod3;
  csexmod3x3=-3;
  for (x=0; x<N+5; ++x) {
    csexmin1mod3x3 = csexmod3x3;
    csexmod3x3 = (x%3)*3;
    csexmin2mod3x3 = 9-csexmod3x3-csexmin1mod3x3;
    ...
    if (x>=4 && x<=N+3 && y>=3 && y<=M+1) {
      if ((x-5)>=1 && (y-3)>=1) {
        if (out_compute == 255) {
          if (comp_edge_pixels[csexmin1mod3x3 + cseymod3] < comp_edge_middle) out_compute=0;
          ...
          if (comp_edge_pixels[csexmin1mod3x3 + cseymod3] < comp_edge_middle) out_compute=0;
          ...
          if (comp_edge_pixels[csexmin2mod3x3 + cseymod3] < comp_edge_middle) out_compute=0;
          ...
        }
      }
    }
    if ((x-3)<=N-2 && (y-2)<=M-2) {
      maxdiff_compute =
        max13(abs(gauss_xy_pixels[csexmin2mod3x3 + cseymod3]
          - gauss_xy_middle), maxdiff_compute);
      ...
      maxdiff_compute =
        max13(abs(gauss_xy_pixels[csexmin2mod3x3 + cseymod3]
          - gauss_xy_middle), maxdiff_compute);
      ...
      maxdiff_compute =
        max13(abs(gauss_xy_pixels[csexmod3x3 + cseymod3]
          - gauss_xy_middle), maxdiff_compute);
      ...
    }
  }
}
}
}

```

FIG. 10

```

cseymod3 = -1;
for (y=0; y<M+3; ++y) {
    cseymin1mod3 = cseymod3;
    cseymod3 = y%3;
    cseymin2mod3 = 3-cseymod3-cseymin1mod3;
    csexmod3x3=-3;
    cseymin1mod2 = (y-1)%2;
    cseymod2=1-cseymin1mod2;
    for (x=0; x<N+5; ++x) {
        csexmin1mod3x3 = csexmod3x3;
        csexmod3x3 = (x%3)*3;
        csexmin2mod3x3 = 9-csexmod3x3-csexmin1mod3x3;
        csexmin1x2 = (x-1)*2;
        csexmin3x2 = csexmin1x2-4;

        ...
        if (x>=3 && x<N+3 && y>=2 && y<M+2)
            tmparray[(csexmin3x2+ cseymod2)%160
                    + (csexmin3x2+ cseymod2)/160*256 + 96]
                = comp_edge_pixels[csexmod3x3
                                + cseymin2mod3] = maxdiff_compute;

        ...
        if (x>= 1 && x<N+1 && y>=1 && y<=M)
            tmparray[(csexmin1x2 + cseymin1mod2)%64
                    + (csexmin1x2 + cseymin1mod2)/64*256]
                = gauss_xy_pixels[csexmin1mod3x3
                                + cseymin1mod3] = gauss_xy_compute;

        ...
    }
}

```

**FIG. 11**

```

cseymod3=-1;
for (y=0; y<M+3; ++y) {
  cseyminlmod3=cseymod3;
  cseymod3 ++;
  if(cseymod3 >= 3){cseymod3 -= 3;}
  cseymin2mod3 = 3-cseymod3-cseyminlmod3;
  cseyminlmod2 = (y-1)&1;
  cseymod2=1-cseyminlmod2;
  csexmod3x3= -3;
  csexx2mod160_1_2=cseymod2-8;
  csexx2div160_1_2=0;
  for (x=0; x<N+5; ++x) {
    csexminlmod3x3=csexmod3x3;
    csexmod3 ++;
    if(csexmod3 >= 3){csexmod3 -= 3;}
    csexmod3x3=csexmod3*3;
    csexmin2mod3x3 = 9-csexmod3x3-csexminlmod3x3;
    csexx2mod160_1_2+=2;
    csexminlx2 = (x-1)*2;
    csexmin3x2 = csexminlx2-4;
    if(csexx2mod160_1_2>=160) {csexx2mod160_1_2-=160;csexx2div160_1_2++;}
    ...
    if (x>=3 && x<N+3 && y>=2 && y<M+2)
      tmparray[csexx2mod160_1_2 + csexx2div160_1_2*256 + 96]
        = comp_edge_pixels[csexmod3x3
          + cseymin2mod3] = maxdiff_compute;
    ...
    if (x>= 1 && x<N+1 && y>=1 && y<=M)
      tmparray[((csexminlx2 + cseyminlmod2)&63)
        + ((csexminlx2 + cseyminlmod2)>>6)*256]
        = gauss_xy_pixels[csexminlmod3x3
          + cseyminlmod3] = gauss_xy_compute;
    ...
  }
}

```

**FIG. 12**

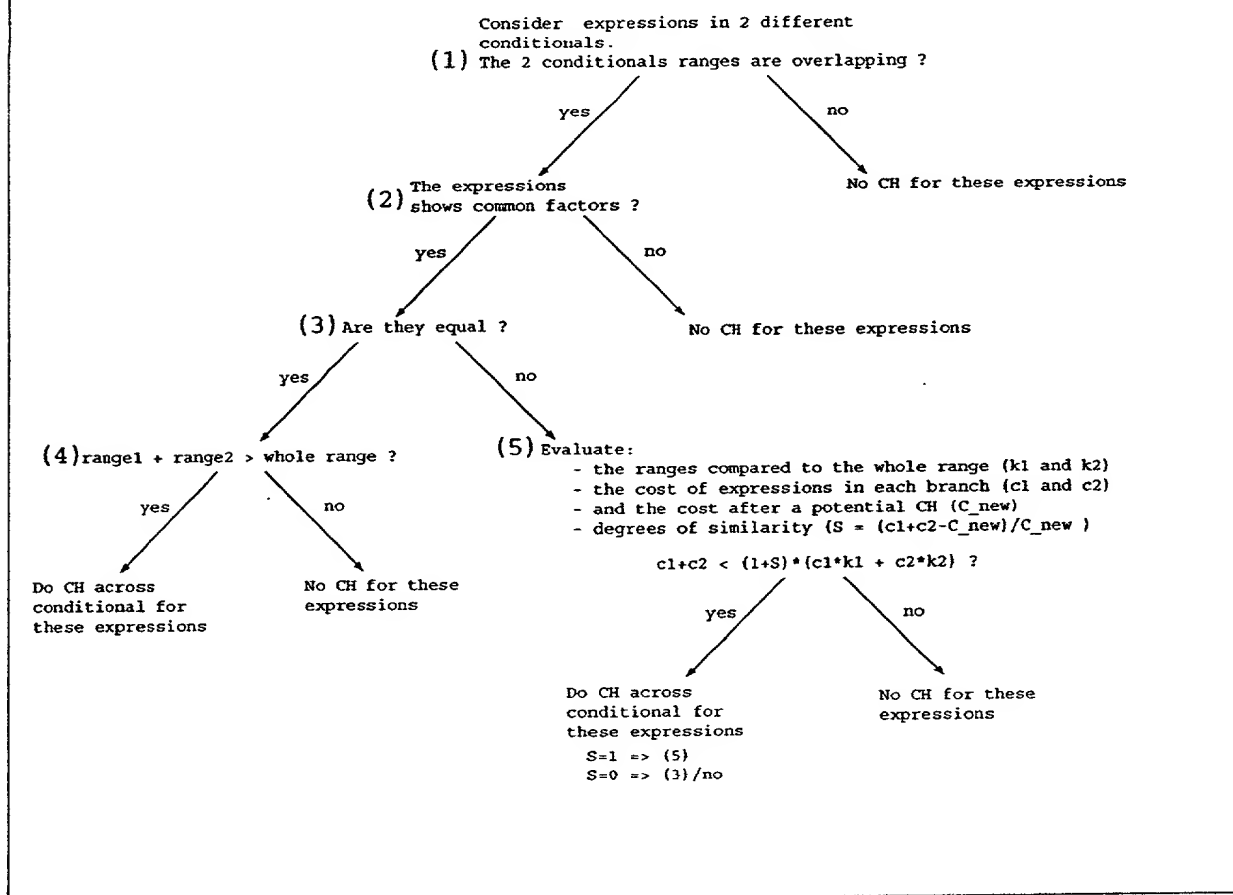


FIG. 13